



EPA Region 7 TMDL Review

TMDL ID: IA 04-UDM-3850_L **Waterbody ID:** IA 04-UDM-03850-L
Waterbody Name: FIVE ISLAND LAKE
Tributary:
Pollutant: ALGAE, TURBIDITY
State: IA **HUC:** 07100002
BASIN:
Submittal Date: 9/22/2006
Approved: Yes

Submittal Letter

State submittal letter indicates final TMDL(s) for specific pollutant(s)/water(s) were adopted by the state, and submitted to EPA for approval under section 303(d) of the Clean Water Act.

The TMDL for Five Island Lake was formally submitted by the Iowa Department of Natural Resources (IDNR) in a letter received by EPA on September 22, 2006.

Water Quality Standards Attainment

The water body's loading capacity for the applicable pollutant is identified and the rationale for the method used to establish the cause-and-effect relationship between the numeric target and the identified pollutant sources is described. TMDL and associated allocations are set at levels adequate to result in attainment of applicable water quality standards.

The loading capacity is set through the use of a lake response model to target the annual amount of total phosphorus (TP) that Five Island Lake can receive to meet its designated uses. To address the identified pollutants (algae and turbidity), the Carlson's Trophic State Indices (TSI) were used to link the concentration of TP to the quantity of algae and turbidity as measured by Secchi depth (SD). By setting a TSI for TP of less than 68, the chlorophyll (algae) and SD (turbidity) indices are expected to be reduced to below 65; thereby meeting the desired Iowa's narrative water quality standards (WQS). These corresponding concentration values for TP and chlorophyll are 82 ug/L and 33 ug/L, respectively and the SD target is equivalent to 0.7 meters (m). To achieve the TP TMDL target, an 8% reduction in loading is established. Because lake conditions represent responses to environmental load occurring over an extended period of time, expression of the load as an average annual value is the preferred approach found in current scientific limnological literature. Expressing the TMDL in daily time steps would mislead the reader by implying a daily response to change in daily loading. Although a short-term response after a precipitation event could have localized lake effects, Iowa assesses the mean conditions of their lakes over the growing season, for example, an average of 3 samples per summer over multiple years. The growing season mean is affected by factors such as the following: internal lake nutrient loading, water residence time, wind action, and the interaction between light penetration, nutrients, turbidity, sediment load, and algal response. An error is noted on Table 3 that has the target at <70 TSI-P; the text on page 8 has the correct target -- noted in email communication with IDNR on September 25, 2006.

Numeric Target(s)

Submittal describes applicable water quality standards, including beneficial uses, applicable numeric and/or narrative criteria. If the TMDL is based on a target other than a numeric water quality criterion, then a numeric expression, site specific if possible, was developed from a narrative criterion and a description of the process used to derive the target is included in the submittal.

Designated uses of Five Island Lake are Primary Contact Recreation (A1) and Aquatic Life Support (B (LW)). Five Island Lake was included on the impaired waters list due to algae and turbidity impairments. The Class A (primary contact recreation) uses are assessed (monitored) as "partially supporting" due to slightly elevated turbidity related to levels of algae and inorganic suspended solids at Five Island Lake. The Class B(LW) aquatic life uses are assessed (evaluated) as "fully supporting / threatened" due to algae and non-algal turbidity. The State of Iowa does not have numeric criterion for nutrients or turbidity in their WQS. The lake, however, exceeded the narrative WQS which states that "water shall be free" from aesthetically objectionable conditions. Carlson's TSI were used to link the concentration of TP to the quantity of algae and turbidity as measured by SD.

Numeric Target(s) and Pollutant(s) of concern

An explanation and analytical basis for expressing the TMDL through surrogate measures (e.g., parameters such as percent fines and turbidity for sediment impairments, or chlorophyll-a and phosphorus loadings for excess algae) is provided, if applicable. For each identified pollutant, the submittal describes analytical basis for conclusions, allocations and margin of safety that do not exceed the load capacity.

Carlson's TSI scores were used to define an established linkage between TP, chlorophyll, and water transparency as based on reference lakes. Phosphorus is the principal nutrient target. The Canfield-Bachman Natural Lake model was used to relate TP loading to growing season in-lake concentrations. Because phosphorus is closely related to suspended solid, reduction in either contaminant is expected to have a commensurate reduction in the other.

The existing TP load to Five Island Lake is estimated to be 4,408 pounds per year (lbs/y). The relatively low phosphorus (88 ug/L) and inorganic suspended solids (12 mg/L) at Five Island Lake indicate an insignificant internal loading and also suggest that non-algal turbidity is not the principal cause of the turbidity impairment. Turbidity is caused by algal conditions. By reducing the TSI for TP from the current level of 69 to 68 the TSI score for Secchi should respond by a commensurate decrease based on the relationship seen in this lake; therefore, the target Secchi TSI score of less than 65 should result. The TP loading capacity is set at 4,065 lbs/y. The TMDL does not establish daily loads because lake response is a result of the loading for an extended time period prior to any given measurement. There is little, if any benefit, in modeling the lake neither on a daily basis nor to establish targets on a daily basis. While localized turbidity and, to some degree, algae may be tracked as responding to short-term rainfall, whether the targets were set on a yearly basis or on a daily basis would not change the implementation practices necessary for this nonpoint source only TMDL.

Source Analysis

Important assumptions made in developing the TMDL, such as assumed distribution of land use in the watershed, population characteristics, wildlife resources, and other relevant information affecting the characterization of the pollutant of concern and its allocation to sources, are described. Point, non point and background sources of pollutants of concern are described, including magnitude and location of the sources. Submittal demonstrates all significant sources have been considered.

Only nonpoint sources influence the TP and sediment loading. There are no point source discharges in the watershed. All sources of TP have been considered.

Allocation

Submittal identifies appropriate wasteload allocations for point, and load allocations for nonpoint sources. If no point sources are present the wasteload allocation is zero. If no nonpoint sources are present, the load allocation is zero.

The TMDL document set a TP allocation at 4,065 lbs/year. To translate the long-term averages to maximum daily values EPA used the approach described in the Technical Support Document for Water Quality-based Toxics Control (EPA/505/2-90-001). The Maximum Daily Load (MDL) equals the Long Term Average (LTA) * exp ($z \cdot \sigma - 0.5 \cdot \sigma^2$). Phosphorus is expected to have large coefficients of variation (CV); recent evaluation of sediment data for TMDLs in Missouri showed CVs from about 3 to 10 for sediment constituent (phosphorus would be expected to be similar.) For establishing this TMDL, a conservative CV of 2 and a 99th percentile occurrence probability were assumed for translating the LTA to a MDL. Using these assumptions, the MDL=LTA*8.55. Therefore, the TP TMDL would be $(4,065/365) \cdot 8.55 = 95$ pounds/day.

WLA Comment

The WLA is set to zero.

LA Comment

The Load Allocation (LA) of TP for this TMDL is 3,292 lbs/y

Nonpoint sources in the Five Island Lake watershed include agricultural production land and pasture. An 8% reduction in TP loading to the lake is needed.

Margin of Safety

Submittal describes explicit and/or implicit margin of safety for each pollutant. If the MOS is implicit, the conservative assumptions in the analysis for the MOS are described. If the MOS is explicit, the loadings set aside for the MOS are identified and a rationale for selecting the value for the MOS is provided.

The MOS is set explicitly to 10% for TP.

Seasonal Variation and Critical Conditions

Submittal describes the method for accounting for seasonal variation and critical conditions in the TMDL(s).

The TMDL target was derived using May through September data when nuisance algal blooms and low transparency in Five Island Lake were most likely to occur. By using data from this most problematic period instead of the entire year, the target is meant to prevent nuisance algal bloom and low transparency occurrences year-round. If a phosphorus limit were instituted for the growing season only, it would ignore the effects of nutrient re-suspension in the water column within Five Island Lake.

Public Participation

Submittal describes public notice and public comment opportunity, and explains how the public comments were considered in the final TMDL(s).

The TMDL was available on Iowa's web site for at least 30 days prior to the close of the public comment period on August 18, 2006. The IDNR held a public meeting on July 26, 2006 in Emmetsburg. Public comments received were given consideration and, where appropriate incorporated into the final TMDL.

Monitoring Plan for TMDL(s) Under Phased Approach

The TMDL identifies the monitoring plan that describes the additional data to be collected to determine if the load reductions required by the TMDL lead to attainment of WQS, and a schedule for considering revisions to the TMDL(s) (where phased approach is used).

Further monitoring is needed at Five Island Lake to follow-up on the implementation of the TMDL. This monitoring will, at a minimum, meet the minimum data requirements established by Iowa's 305(b) guidelines for a complete water quality assessment (3 lake samples per year over 3 years, 10 lake samples over 2 years, etc). Lake monitoring is currently ongoing at Five Island Lake, with a minimum of three samples collected per growing season.

Reasonable assurance

Reasonable assurance only applies when reductions in nonpoint source loading is required to meet the prescribed waste load allocations.

There are no point sources in the watershed and reasonable assurances are therefore not required.